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Effectiveness Worksheet with Problem Solving Approach

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Abstract

Every individual has the potential to be developed. Student as an individual learner in schools has the diversity potential to learn so has the learning outcome. Learning outcomes ara no learning, rote learning and learning meaningfull. However, efforts in facilitating learning in the classroom have given to students who are learning no results. This study will test the effectiveness of the use of worksheets with problem solving approach in facilitating learning with regard to the three learning outcomes.

Assessment of effectiveness using pretest and posttest assessment. Pretest and posttest will make use of 5 items problem about the items number 1-4 will be used to assess the similarity of the about three groups achieving minimum completeness criteria (KKM). Problem item number 5 is used to assess the achievement both of rote learning and meaningfull group. The completeness criteria is 80% of maximum score test. Pretest assessment to obtain subject observations. At the end of the lesson, the subject will be evaluated about achievement of competences. The results will be classified in mastery or no mastery. Achievement KKM will be analyzed using nonparametric chi-square statistics and binomial.

The results obtained that group learning can be increased from no learning to rote learning, 27 students completed and 6 students did not complete. Therefore P (X ≥27, 1/2) = 0,0002 and $Z_{3.48}$ = 0,0002 then no learning to rote learning increase. The students of rote leaning and learning meaningfull group are reach 100% completed. There are 12 students completed and 17 are not complete in rote learning group; reached 15 complete and 14 incomplete in meaningfull learning group. Comparison of performance of both groups was the same thoroughness ($\chi_o^2 = 0{,}64 < \chi_{(0,5;1)}^2 = 3{,}84$). Its mean, rote learning can be increased to meaningfull learning. The Conclusion is learning worksheets with problem solving approach is able to facilitate increased student learning potential.
Keywords: Learning, Effectiveness, Problem Solving.

A. Background

Challenges and problems will always be present in the striving for individual learning and active living. Challenges and problems also occur in the learning of mathematics. These challenges include: Indonesian student mathematics achievement in the international is low, mathematical literacy of students related to their environment is not yet good, even considered the scourge of the student, the diversity of potential students. Problems also occur in the learning of mathematics such as the student's skills and not just a mere imitation as something constructed in students, students who lack motivation towards mathematics and associated with even an attempt to facilitate learning in the classroom have given to students who have no learning outcomes solely. The answers of problems and challenges can using worksheets approach problems soving as means of learning.

B. Study

Embodiment insistence on growth and development of an individual referred to as educational activities with the goal of protecting the cultural, preparing labor and realize humanist (Imam Barnadib, 1988: 17-55). The educational activities will be determined

by the individuals who will grow and develop, the situation (Gagne, 1977: 4-5) and teachers who facilitate grow and development of an individual or group of individuals. Processes that occur at the individual referred to learning. Some definitions of learning, Gagne (1977: 3), Hegerhahn & Oslon (2008: 8), Boorich (2007: 61) and Moore (2009: 61) view learning as a change in an individual's capacity. Boorich (2007: 23), Joyce & Weil (2004: 13), Saosa (2008: 55), Sturomski (1997: 2) and Gravemaijer (2010: 41) view learning as a process of construction of knowledge. Sambaugh & Maglioro (2001: 70) and Vygotsky (Santrok, 2009: 62) learning as students of construction of knowledge through the help of the others.

Although these opinions vary in defining learning, but they agreed that the achievement of an individual learning can be observed when they make a response to an event as the embodiment of their own frameworks for the incident (Cord, 1999: 1). Achievement will be tested using the test. This does not mean a person assess learning outcomes, but only as a top scoring learning and achievement can be interpreted corresponds to the intended use of the test. Mastery for competed the lessons if has 80% maximum test scores (Kemp, Morrison & Ross, 1994: 289). Learning effective if the students are mastery the lessons 80% of all.

On the learning achievement of someone known to the learning outcomes. The learning outcomes are grouped into three categories: no learning, rote learning and meaningful learning (Mayer, 2002: 266; Anderson & Krathwohl, 2001: 64-65). Learning outcomes are assessed based on the ability of individuals in retention and transfer of information. Polya suggested as a result of the student's ability to learn (Utari Somarmo, 2010: 4) the ability of mechanical understanding, inductive understanding, rational understanding, and intuitive understanding.

Teachers play a role in helping the growth and development of individual students should be aware that teaching is an activity to seek practical ways to develop students' intellectual integrity (Baird: 1987: 6), but these efforts are not just limited to producing the correct answer. Although the determination of student learning outcomes is the most important thing in education (Gronlund & Lin, 1990: 23), but also the integrity of students' intellectual needs attention also to the realization of the mental quality of the students. This means that learning is not only oriented to learning outcomes but also the process-oriented learning (Weinstein & Mayer, 1983: 3). Therefore, goal setting and much insight enrichment needed. Enrichment insight confront done using the knowledge of students who had previously owned with a new problem situation and strengthening students' construct knowledge more permanenty accommodate. Enrichment insight and confrontation will occur properly correspond to the conditions of the students. Conditions such students may be thinking style or styles of learning, culture and lift, and the difficulties in their learning activities.

Students Tendency of receive knowledge as well as learning styles. Learning styles according to Adam & Hamm (2010: 14) are, mastery learning styles, understanding learning styles, learning styles self-expressive, and interpersonal learning style. Learning styles according to Santrock (2009: 174-176) which include impulsive-reflective style and deep-level style. Deep-surface style is a person's tendency to process information (Jacobsen, Eggan & Kauchak, 2009: 280). Gregorch learning styles (Herold, 2004: 14; McNeil, 1990: 138) are, Concrete-Sequential, Concrete-Random, Abstract-Sequential, Abstract-Random.

Mathematics is one of the growth of the content. Ministerial Regulation No. 22 of 2006 to include mathematics as a subject in school. Defining of Mathematics is very diverse. Mathematics, according Trefil & Hazen (2000: 4) and Scoenfold (1992: 335) is a short language that communicates the results of scientists and often make predictions became more precise or can also be regarded as an equation. Thus according to Ernest, mathematics can be regarded as the absolute truth of science (Francois, 2007: 22). Mathematics as an equation means connecting identical quality over something and load symbols. Mathematics according Hayloac & Tangata (2007: 100) can be understood through interrelated-language symbolize, image and real-world life situations.

The statement "scientists" would not be wise enough when used as a predicate to the school students. Therefore, the content of mathematics as a science needs to be adjusted in order to be studied and understood by students. Content mathematics in elementary and secondary school level has a different structure to the mathematical structure of the college as stated by Francois (2007: 23) and Soejadi (2000: 37).

Structure of mathematical school can be referenced on Bishop and Bell statement. Math activities that are counting, locating, measuring, designing, playing and explaination (1988: 182-184). Objects in the learning of mathematics is the direct object (facts, concepts, principles and skills) and indirect object (problem solving). Mathematics Knowledge according to Kinard & Kozulin (2008: 27) are conceptual understanding, procedures understanding, and mathematical insights. According to Ball (2003: 9), the knowledge of which: conceptual knowledge, flexibility and capability procedures strategies.

In activities in the classroom, teachers facilitate student learning in 2 ways with procedural and conceptual understanding (van den Walle, 2008: 38). Still according to van den Wall, both will be effective learning by task problems. Related to learning about the task, teachers need to focus on the ideas and understanding of the diversity of students and facilitate problem solving.

The problem solving approach is a way of presenting problems involving a minimum of two concepts. Things that need attention in the context (Cai & Nie, 2007) and misconceptions (Kajander and Lovric, 2009). Strategies that can be selected by the teacher in the implementation of the learning problem solving are using the steps suggested by Polya (1973: 289). Teachers will use the scaffolding in this strategy. In groups of no learning, instruction will be implemented to facilitate student's ability to read a comprehensive so that information on the task can be found by the students alone and find solutions. In the group of rote learning, the instruction will be conducted in a manner to facilitate the students' ability for independently find and determine strategies to achieve a solution. In meaningfull group learning, the learning will be conducted in a manner to facilitate the students' ability for independently find and determine strategies to achieve solutions of the problems and develop their knowledge and mathematical literacy.

C. Method

This study used three groups of students (29 students wera meaningfull, 29 students were rote learning, and 33 students were no learning) of the school in Education Department of Yogyakarta with curved side matter. Assessment of effectiveness using the worksheets be regarded pretest and posttest design equivalent. Pretest used to obtain the observation subject. Posstest used as an instrument to evaluate effectiveness program.

Posstest and pretest design consists of 2 parts, the test questions item number 1-4 are a transfer capability assessment on learning outcomes rote learning. Test questions item number 5 is a transfer capability assessment test on meaningful learning. As the completeness criteria of learning by using worksheets with problem solving approach was used at least 80% completeness criteria.

Learning to use the worksheets with problem solving approach to be effective if it is able to facilitate increased learning outcomes no-learning to rote learning, increasing rote-learning to meaningfull, and a strengthen meaningful learning outcomes. For this purpose the statistical test equipment will be used non-parametric statistics. Statistics of the test will use a chi-square (χ^2) and binomial (Furqan, 2004: 235; Heiman, 2011: 352-354; Walpole et al., 2012: 655-669).

D. Results

Distribution of students at pretest and posttest about completed categories of the lessons shown in Table 1 and Table 2.

Table 1
Distribution completeness Students about Problem item 1st-4th

	No Learning		Rote Learning		Meaningfull	
	Pre test	Post test	Pre test	Post test	Pre test	Post Test
Mastery	0	27	0	29	0	29
No mastery	33	6	29	0	29	0
Percentage of completion (%)	0	81,82	0	100	0	100
Particapant	33		29		29	

Table 2
Distribution completeness Students of Problem item 1st-5th

	No Learning		Rote Learning		Meaningfull	
	Pre test	Post test	Pre test	Post test	Pre test	Post Test
Mastery	0	0	0	12	0	15
No mastery	33	33	29	17	29	14
Percentage of completion (%)	0	0	0	41,38	0	51,72
Particapant	33		29		29	

1. **The effectiveness worksheets about Basic Competence**

   Learning effectiveness in a group decision statement is intended to assess the achievement of students' minimum completeness criteria (KKM) after the worksheets with problem solving approach used in learning by each group as well as the decision on the minimum completeness criteria in common achievement of

all three groups. This assessment uses about THB posttest item 1, 2, 3 and 4, as an indicator of mastery of basic competencies in materials with curved side.

Table 3
Completeness Group of Problem item 1st-4th

Completeness	Kelompok Siswa		
	R	N	M.
Mastery	29	27	29
No mastery	0	6	0

N : no learning R: rote learning M : meaningfull learning

The results of the analysis of no learning group obtained P (X≥27, 1/2) = 0,0002, while the $Z_{3.48}$ = 0,0002. In other words P (X≥27, 1/2) = P ($Z_{3,48}$). This result indicates that the 95% confidence level can be inferred more than 80% of students are able to achieve the minimum completeness criteria after worksheets with problem solving approach used in the instructional. Thus after worksheets is used in learning, group student who outcomes no learning is capable of rising to the learning rote learning. On the other hand, the group rote and meaningfull group were able to achieve 100% mastery. Thus the following three groups using worksheets effectiveness criteria are met for each group. Therefore this worksheets are effective for using in instructional.

Table 4.
Comparisons between groups of problem item 1st-4th

Observation			Group			Total
			N	R	M	
Completeness	Mastery (T)	F_o (T) F_e (T) $\frac{(F_o(T) - F_e(T))^2}{F_e(T)}$	27 27,09 0,47	29 30,82 0,13	29 27,09 0,13	85
	No Mastery (TT)	F_o (TT) F_e (TT) $\frac{(F_o(TT) - F_e(TT))^2}{F_e(TT)}$	6 2,18 6,72	0 1,91 1,91	0 1,91 1,91	6
Total			33	29	29	91
χ^2_{obs}			11,27			
$\chi^2_{(0,5;2)}$			5,995			

Description: Fo (T) = Number of students mastered the lessons
Fe (T) = Number of students expectated for mastery the lessons
Fo (TT) = Number of students did'n mastery the lessons
Fe (TT) = Number of students expectate did'n mastery the lessons

Table 5
Achievement students N and R Group about Problem item 1st-4th

Observation			Group		Total
			R	N	
Completeness	Mastery (T)	F_o (T) F_e (T) $\frac{(F_o(T) - F_e(T))^2}{F_e(T)}$	29 26,19 0,30	27 29,81 0,26	56
	No Mastery (TT)	F_o (TT) F_e (TT) $\frac{(F_o(TT) - F_e(TT))^2}{F_e(TT)}$	0 2,81 2,81	6 3,19 2,47	6
Total			29	33	62
χ^2_{obs}			5,84		
$\chi^2_{(0,5;2)}$			3.84		

The decision on similarity achieving study group about competency of curved side will be done by comparing the proportion of students who minimum completeness criteria achieve on posttest in each. Table 4 presents the achievement of students above minimum completeness criteria. The results of the analysis diperloleh that $\chi^2_o > \chi^2_{(0.5;2)}$. Thus concluded that the achievement of minimum completeness criteria for all three groups are not the same. Nevertheless, the achievement of minimum completeness criteria similarity of the two groups can be tested. Testing on the achievement of minimum completeness criteria in common is no similarity between the rote learning and group learning, similarities between groups of no meaningfull learning and group learning, as well as similarities between the rote learning and group learning meningfull.

The similarities between of no learning for both rote learning and meaningfull group will use the chi square test (χ^2). Table 5 and Table 6 presents the results of the similarity analysis no learning group with each other group. As for the similarity test between groups meaningfull rote learning and group learning will be used binomial tests.

Table 6
Achievement students M and R Group about Problem item 1st-4th

Observation			Group		Total
			N	M	
Completeness	Mastery (T)	F_o (T) F_e (T) $\frac{(F_o(T) - F_e(T))^2}{F_e(T)}$	27 29,81 0,26	29 26,19 0.30	56
	No Mastery (TT)	F_o (TT) F_e (TT) $\frac{(F_o(TT) - F_e(TT))^2}{F_e(TT)}$	6 3,19 2,47	0 2,81 2,81	6
Total			33	29	62
χ^2_{obs}			5,84		
$\chi^2_{(0,5;2)}$			3.84		

The results of the analysis in Table 5 shows that the $\chi_o^2 > \chi^2_{(0,5;1)}$. Thus the achievement of students no learning groups is not the same with rote learning group achievement. In other words that the achievement of rote learning groups is better than no learning groups. From Table 6 obtained the same result, $\chi_o^2 > \chi^2_{(0,5;1)}$. Thus the achievement of students no learning groups is not the same with meaningfull learning group achievement. In other words that the group meaningfull learning outcomes better than no learning groups.

To compare the achievement of rote learning group with meaningfull learning group will use the binomial test. Comparing the results of the acquisition scores of each student in the group of rote learning and meaningfull learning, proposed the hypothesis that the achievement of student learning meaningfull group larger than rote learning achievements of the students group. Students will be paired with 1-1 corresponding serial number list of students. Then the score of the pair is marked with a plus sign (+) or sign (-). After comparing the value of the outcome, there are 6 pairs of students plus sign (+) and 10 sign (-). Thereby P (X <6; 1/2) is 0,227. On the other hand Z= -0,75, so that P (Z = -0.75) = 0,227. Therefore P (X <6; 1/2) = P (Z = -0,75) = 0,227, then the hypothesis is true. This means, rote learning students achievement and student of meaningfull group is the same. In other words, the 95% confidence level, the group concluded that rote learning achievement of students is able to match the achievement of student learning meaningfull group.

2. **The effectiveness of worksheets (rote and meaningful learning).**

The effectiveness of worksheets in a facility to seek improvement rote learning and learning meaningfull improvement will be tested with problem item number 1-5. Table 7 presents the analysis of student achievement on rote learning and meaningfull learning groups using chi square test (χ^2). The results of the analysis in Table 7 shows that the $\chi_o^2 < \chi^2_{(0,5;1)}$. Thus the achievement students of rote learning and meaningfull group is the same. In other words, that the results of rote learning is increase to meaningfull. The effectiveness of the wirksheets in effort to facilitate the learning of rote learning into meaningfull learning significantly. However, these worksheets have not been effective as a instructional tool in the meaningfull learning (students mastery 59% of all.

Table 7.
Achievement students R and M Group about problem 1st-5th

Observasi			Kelompok		Jumlah
			R	M	
Ketuntasan	Tuntas (T)	F_o (T) F_e (T) $\frac{(Fo\ (T) - Fe\ (T))^2}{Fe\ (T)}$	12 13,5 0,17	15 13,5 0,17	27
	Tak Tuntas (TT)	F_o (T) F_e (T) $\frac{(Fo\ (TT) - Fe\ (TT))^2}{Fe\ (TT)}$	17 15,5 0,15	14 15,5 0,15	31
Jumlah			29	29	58
χ^2_{obs}			0,64		
$\chi^2_{(0,5;1)}$			3,84		

Based on the results of testing the effectiveness of the above it can be concluded that the use of worksheets with problem solving approach to learning can improve student learning outcomes. Students were no learning can be increased to rote learning students, and students who rote learning can be increased to student learning meaningfull. However worksheets with problem solving approach has not been able to facilitate students reinforcement meaningfull.

E. Conclusion

Learning is an active and dynamic process. In the effort to improve the learning of pupils can do with diversity way, but the important thing that also will be influence the achievement of these learning outcomes are learning styles, learning environment, content and mediation processes that occur in learning. Worksheets can be used as a medium of learning that can facilitate efforts to the progressive increase learning outcomes. Worksheets with problem solving approach is able to facilitate students to achieve mastery in learning and able to facilitate learning outcomes that no learning increased to be rote learning and rote learning to be meaningfull learning. Usage Worksheet needs to be tailored to the learning methods that will be implemented in the classroom.

Problem solving approach to provide integrated learning opportunities and further emphasize student involvement in learning, making students actively involved in the learning process and problem solving steps, empowering students to solve problems, to foster creativity in accordance with the needs of students, and provide a challenge to students through the presentation of the problem. Problem solving approach also makes the teacher as facilitator of learning can be more creative and active in preparing opportunities/experiences learning for students.

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